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ABSTRACT

The performance patterns of Mexican-American seventh-grade students on five mathematics tests were compared with those of a predominantly Anglo group of students. Measures included two tests of general mathematical ability (Five Dots and Necessary Arithmetic Operations), a test on division of whole numbers, a test on prime numbers, and a posttest for a programmed instructional sequence on factorization of whole numbers. Summary statistics for the first four tests are presented for both groups; the Mexican-Americans scored slightly below the Anglos on the first three tests. Correlations between test scores were computed for both groups. None of the correlations were significantly different from 0 for the Mexican-American group, while all but one were positive for the Anglo group. This study (together with previous studies) suggests that the intellectual functioning of Mexican-American children is different from that of Anglo children. (SD)

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SMSG RESEARCH AND ANALYSIS SECTION

November 1972

Working Paper No. 12

By: E. G. Begle

Subject: Learning Correlates for Mexican-American Students

During the 1971-72 academic year, the Research and Analysis section of the SMSG staff carried out a number of experiments, all of them investigating the value of review of mathematical topics when students did not master the topics the first time. SMSG Research and Analysis Working Papers 6, 7, 9, and 10 report these experiments. In the remainder of this report, the first of these experiments, which is reported in Working Papers 6 and 7, will be referred to as the Initial Study.

In most of these studies, the subjects were white, middle class students in grades five or six. The experiment reported in this working paper was designed to find out if the procedures used in the previous experiments would have useful effects on Mexican-American students. In the remainder of this report, this experiment will be referred to as the Follow up Study.

On the basis of advice provided by the principal research assistant for this experiment, Mr. John Trevino, who had had considerable classroom experience with Mexican-American elementary school students, it was decided to use seventh grade students. The Fisher School*, in the Alum Rock District of San Jose, provided two classes, in each of which the majority of students had Spanish surnames.

The treatment used in this experiment was the same as in the earlier experiments. Three versions of a programmed unit on factors of whole numbers and on prime numbers were used. Form A., which has five parts, included a moderate number of illustrative and practice examples. Eahc part of Form B was exactly parallel to the corresponding part of Form A, but all the illustrative and practice examples were modified, mainly by changing the numerical

*We acknowledge with thanks the cooperation and assistance of the principal, Ray Dore, and of the teachers of the two classes, Miss Eleanor Irving and Mr. Edward J. Blum.

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values. Form AB was also parallel to Form A, but it contained all the illustrative and practice examples in Form A together with all those in Form B.

Half the students were asked to work through the first part of Form A. When this was done, a short test (Test 1a) was administered. It was scored immediately and the student was shown which problems had been worked incorrectly. The student was then asked to review by working through the first part of Form B. When this was finished, Test 1b, parallel to Test 1a, was administered.

Next, the student worked through the remaining parts, in succession, of Forms A and B. During the ten class periods made available for this experiment (one additional period was used for pretesting), a few students were able to work through all five parts, but the number finishing began to drop off rapidly after the third part.

The remaining half of the students worked through Form AB. At the end of the first part, they were administered Test 1, which was the union of Tests 1a and 1b. They then went on to Part 2, etc. As with the other half of the students, the number finishing began to drop off rapidly after the third part.

The day before the experimental treatment started, a battery of pretests was administered. All of these had been used in the earlier studies. Two of these were tests of general mathematical ability, "Necessary Arithmetic Operations" and "Five Dots", which had been found, in analyses of data from the National Longitudinal Study of Mathematical Abilities, to be good predictors of mathematics achievement. A third set measured skill in division of whole numbers. The last, a test on prime numbers, was used to find out if any of the students already knew some of the material in the programed lessons.

"Necessary Arithmetic Operations", "Five Dots", and "Factors and Primes" were multiple choice, with four answer choices for the first, five for the second, and a mixture of four and five for the third. For the division test, the students were to write their answers in the test booklet.

In Table 1 we provide summary statistics on these pre-tests, calculated for only those students with Spanish surnames. We also provide in Table 1 the same statistics from the Initial Study.

Table 1

Summary Statistics for the Pretests

| Initial Study | | Follow up Study | |
|---|---|---|---|
| **Five Dots** | | | |
| Number of Cases | = 100 | Number of Cases | = 35 |
| Number of Items | = 19 | Number of Items | = 19 |
| Mean Total Score | = 13.210 | Mean Total Score | = 10.314 |
| Standard Deviation | = 4.239 | Standard Deviation | = 2.572 |
| Cronbach's Alpha | = 0.853 | Cronbach's Alpha | = 0.525 |
| Error of Measurement | = 1.622 | Error of Measurement | = 1.773 |
| **Necessary Arithmetic Operations** | | | |
| Number of Cases | = 100 | Number of Cases | = 35 |
| Number of Items | = 15 | Number of Items | = 15 |
| Mean Total Score | = 8.210 | Mean Total Score | = 6.000 |
| Standard Deviation | = 2.758 | Standard Deviation | = 2.402 |
| Cronbach's Alpha | = 0.696 | Cronbach's Alpha | = 0.640 |
| Error of Measurement | = 1.521 | Error of Measurement | = 1.442 |
| **Division** | | | |
| Number of Cases | = 100 | Number of Cases | = 35 |
| Number of Items | = 7 | Number of Items | = 7 |
| Mean Total Score | = 4.890 | Mean Total Score | = 4.286 |
| Standard Deviation | = 2.209 | Standard Deviation | = 2.325 |
| Cronbach's Alpha | = 0.820 | Cronbach's Alpha | = 0.816 |
| Error of Measurement | = 0.937 | Error of Measurement | = 0.997 |
| **Factors and Primes** | | | |
| Number of Cases | = 100 | Number of Cases | = 35 |
| Number of Items | = 8 | Number of Items | = 8 |
| Mean Total Score | = 2.340 | Mean Total Score | = 2.543 |
| Standard Deviation | = 1.538 | Standard Deviation | = 1.078 |
| Cronbach's Alpha | = 0.474 | Cronbach's Alpha | = -0.034 |
| Error of Measurement | = 1.115 | Error of Measurement | = 1.096 |

It will be noted that the Mexican-American students in the Follow-up Study scored slightly lower than the Anglo students in the Initial Study on the first three tests. However, the reliabilities of these tests were about the same in both Studies, except for "Five Dots" which was slightly less reliable for the Mexican-American students.

As was to be expected, the students scored at about the chance level in both Studies on the pretest covering the material to be learned.

In the previous experiments, the data were analyzed by means of ANCOVA, using the pretests as covariates, to compare the two treatments. In the present study, the small number of cases suggested combining the two treatments (which had not been found to have different effects in the earlier studies). Only Test 1b was analyzed.

Tables 2 (for the Form A Students) and Table 3 (for the Form AB students) give the correlation between the pretests and the scores on Test 1b for the Initial Study. Table 4 gives the correlations for the Follow-up Study.

Table 2

Initial Study (n - 47)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Five Dots | | .51 | .58 | .37 | .64 |
| 2. Nec. Arith. Op. | | | .50 | .41 | .59 |
| 3. Division | | | | .11 | .56 |
| 4. Factors and Primes | | | | | .47 |
| 5. Test 1b | | | | | |

Table 3

(n = 48)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Five Dots | | .43 | .41 | .43 | .62 |
| 2. Nec. Arith. Op | | | .41 | .28 | .48 |
| 3. Division | | | | .13 | .11 |
| 4. Factors and Primes | | | | | .41 |
| 5. Test 1b | | | | | |

Table 4
(n = 35)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Five Dots | | -.04 | .12 | .14 | .23 |
| 2. Nec. Arith. Op. | | | .25 | .29 | -.04 |
| 3. Division | | | | .14 | .23 |
| 4. Factors and Primes | | | | | .12 |
| 5. Test 1b | | | | | |

From Table VII of Fisher and Yates, "Statistical Tables", it can be seen that none of the entries in Table 4 are significantly different from zero at the .05 significance level. However, except for the .11 correlation between Division and Test 1b in Table 3, all the pretests have significantly positive correlations with Test 1b for the Anglo students.

Test 1b consisted of 10 items. Three of these required a constructed response. The remaining seven were multiple choice with four answer choices. The mean score on Test 1b for the Mexican-American students was 6.1, far above the chance level. The low correlations cannot be explained by excessive difficulty of the test.

This is not the first time that an SMSG study has suggested that the intellectual functioning of Mexican-American children is different from that of Anglo children. A study of very low achievers in junior high school was carried out during 1969-71 and included two classes of predominately Mexican-American students. This study is reported in Working Paper No. 5. The test, Necessary Arithmetic Operation, was also used in that study. Its reliability for the Mexican-American students was much lower than for Anglo students. In addition, it was found that for the Anglo students, and also for a third group of mainly Black students, self concepts and attitudes towards mathematics changed in a desirable direction. With the Mexican-American students, however, there were no attitude changes at all

This experiment demonstrates once again that it is not wise to generalize from what we know about the way Anglo children learn to children in other cultures.